Patent Claims

1. A hybrid drive for motor vehicles having an internal combustion engine (7), an electric motor (5), a generator (8) and a branching gearbox (6) which is arranged between the internal combustion engine, the generator and the electric motor, each having a gearbox connection, that is to say a gearbox input and output, for the internal combustion engine, the generator and the electric motor, which is positively coupled via a drive train (4) to driven wheels (2) of the motor vehicle, with the rotation speed (nA) of the drive train being determined, in order to control the hybrid drive, by means of a sensor arrangement which has separate sensors (13 to 17) for determination of measured values of the rotation speed (nV) of the internal combustion engine, the rotation speed (nG) of the generator, the rotation speed (nE) of the electric motor, the rotation speed (nR) of predetermined driven vehicle wheels (2) and/or the rotation speed (nR^*) of further vehicle wheels (1), with a rotation speed which can be verified from the abovementioned measured values in at least two different ways which are asymmetrically redundant relative to one another being used as the rotation speed (nA) of the drive train.

2. The hybrid drive as claimed in claim 1, characterized in that a measured rotation speed (nE) of the electric motor is used as the rotation speed (nA) when a rotation speed of the electric motor (nE_b) calculated from the rotation speeds of the internal combustion engine (nV) and of the generator (nG) is plausible and adequately matches the measured rotation speed of the electric motor (nE) and, furthermore, adequate matching of the measured rotation speed of the electric motor (nE) is provided with a rotation speed of the drive train (nA_b) calculated from the rotation speeds (nR) of predetermined driven vehicle wheels (2).

3. The hybrid drive as claimed in claim 1 or 2, characterized in that a measured rotation speed of the electric motor (nE) is used as the rotation speed of the drive train (nA) when a rotation speed of the electric motor (nE_b) calculated from the rotation speeds of the internal combustion engine and the generator, as well as a rotation speed of the drive train (nA^*_b) calculated from the rotation speeds of further vehicle wheels (1) are plausible, and the measured rotation speed of the electric motor (nE) adequately matches both the abovementioned calculated rotation speed of the electric motor (nE_b) and the abovementioned calculated rotation speed of the drive train (nA^*_b).

4. The hybrid drive as claimed in claim 3, characterized in that a fault signal is additionally produced in order to indicate that the value of the rotation speed of the drive train (nA_b) calculated from the rotation speeds of predetermined driven vehicle wheels is incorrect.

5. The hybrid drive as claimed in one of claims 1 to 4, characterized in that a rotation speed of the drive train (nA_b) calculated from the rotation speeds of predetermined driven vehicle wheels is used as the rotation speed of the drive train (nA) when this rotation speed adequately matches a rotation speed of the drive train (nA^*_b) calculated from the rotation speeds of further vehicle wheels (1), and a rotation speed of the electric motor (nE_b) calculated from the rotation speeds of the internal combustion engine and the generator is plausible and, furthermore, there is no adequate match between the measured rotation speed of the electric motor (nE) and a rotation speed of the electric motor (nE_b) calculated from the rotation speeds of the internal combustion engine and the generator, and a rotation speed of the drive train (nA_b) calculated from the rotation speeds of predetermined drive wheels (2).

6. The hybrid drive as claimed in claim 5, characterized in that a fault signal is produced in order to indicate that the measured rotation speed of the electric motor (nE) is incorrect.

7. The hybrid drive as claimed in one of claims 1 to 6, characterized in that a rotation speed of the electric motor (nE_b) calculated from the rotation speeds of the internal combustion engine and the generator is used as the rotation speed of the drive train (nA) when the calculated rotation speed of the electric motor (nE_b) as well as a rotation speed of the drive train (nA^*_b) calculated from the rotation speeds of further vehicle wheels (1) are plausible and adequately match one another, but a rotation speed of the drive train (nA_b) calculated from the rotation speeds of predetermined drive wheels (2) is not plausible and/or there is no match between a measured rotation speed of the electric motor (nE) and the calculated rotation speed of the electric motor (nE_b) and/or the rotation speed of the drive train (nA^*_b) calculated from the rotation speeds of further vehicle wheels (1).

8. The hybrid drive as claimed in claim 7, characterized in that fault signals are produced in order to indicate that the measured rotation speed of the electric motor (nE) as well as the rotation speed of the drive train (nA_b) calculated from the rotation speeds of predetermined driven wheels (2) of the vehicle are incorrect.

9. The hybrid drive as claimed in one of claims 1 to 8, characterized in that, if there is no verification of the rotation speed to be determined for the drive train (nA), an emergency signal is produced and/or the internal combustion engine (7) and the electric motor (5) are/is stopped.

10. The hybrid drive as claimed in one of claims 1 to 9, characterized in that the measured rotation speed of the

electric motor (nE) and a rotation speed of the electric motor (nE_b) calculated from the rotation speeds of the internal combustion engine (7) and the generator (5) are assessed as being adequately matched provided that the difference between these rotation speeds is within a predetermined tolerance value.

11. The hybrid drive as claimed in claim 10, characterized in that the tolerance value increases as the rotation speeds (nE, nE_b) rise.

12. The hybrid drive for motor vehicles having an internal combustion engine (7), an electric motor (5), a generator (8) and a branching gearbox (6) which is arranged between the internal combustion engine, the generator and the electric motor, each having a gearbox connection, that is to say a gearbox input and output, for the internal combustion engine, the generator and the electric motor, which is positively coupled via a drive train (4) to driven wheels (2) of the motor vehicle, in particular as claimed in one of claims 1 to 11, characterized in that the generator and the electric motor can be controlled by a control arrangement (18) as a function of a nominal/actual value comparison of the ratio of the rotation speeds of the internal combustion engine (nV) and the rotation speeds (nA_b, nR) of the drive train (4) and of the driven wheels (2), respectively.

13. The hybrid drive as claimed in claim 12, characterized in that the nominal value can be predetermined on a parametric basis, in particular as a function of the positions of control elements which are operated by the driver, in particular the gas pedal and/or the brake pedal, and/or as a function of signals from a sensor system which detects parameters of a roadway, for example upward and downward gradients.

14. The hybrid drive as claimed in one of claims 1 to 13, characterized in that the electric motor (5) can be switched to the generator mode, and/or the generator (8) can be switched to the electric motor mode.